**CLAIMS:**

1. A method comprising:

identifying a segment of phase frequency response of a surface acoustic wave sensor; and

estimating a time delay associated with wave propagation through the surface acoustic wave sensor based on the identified segment of phase frequency response.

2. The method of claim 1, wherein identifying the segment of phase frequency response comprises determining first and second phase inflection frequencies proximate to a running frequency associated with the surface acoustic wave sensor.

3. The method of claim 2, wherein determining phase inflection frequencies comprises:

sampling a plurality of phase responses at frequencies proximate to the running frequency and initially estimating phase inflection frequencies as a function of the plurality of phase responses at frequencies proximate to the running frequency;

sampling a plurality of phase responses at frequencies proximate to the initially estimated phase inflection frequencies; and

more accurately estimating the phase inflection frequencies as a function of the plurality of phase responses at frequencies proximate to the initially estimated phase inflection frequencies.

4. The method of claim 2, wherein the first and second phase inflection frequencies define edges of a monotonically changing subset of a graph of phase versus frequency of the surface acoustic wave sensor.

5. The method of claim 2, further comprising estimating the time delay according to approximately the following equation:

$$\hat{\tau}(f_0) = \frac{f_1}{f_0}\frac{1}{f_2 - f_1} - \frac{1}{360}\frac{\phi(f_0)}{f_0} + \frac{0.5}{f_0}$$

where $\hat{\tau}(f_0)$ is the time delay at frequency $f_0$, $f_0$ is the running frequency, $f_1$ is the first phase inflection frequency, $f_2$ is the second phase inflection frequency, and $\phi(f_0)$ is a measured phase response of the surface acoustic wave sensor at frequency $f_0$.

6. The method of claim 1, further comprising estimating the time delay according to approximately the following equation:

$$\hat{\tau}(f_0) = -\frac{1}{360}\frac{f_*}{f_0}\dot{\phi}(f_*) - \frac{1}{360}\frac{1}{f_0}\phi(f_0) + \frac{1}{360}\frac{1}{f_0}\phi(f_*)$$

where $\hat{\tau}(f_0)$ is the time delay, $f_0$ is a running frequency, $\phi(f_0)$ is a measured phase response of the surface acoustic wave sensor, $f_*$ is any frequency between a first phase inflection frequency and a second phase inflection frequency, $\phi(f_*)$ is a measured phase frequency response at the frequency $f_*$, and $\dot{\phi}(f_*)$ is a first order of derivative of the measured phase response at the frequency $f_*$.

7. The method of claim 1, further comprising estimating the time delay according to approximately the following equation:

$$\hat{\tau}(f_0) = -\frac{1}{360}\dot{\phi}(f_0)$$

where $\hat{\tau}(f_0)$ is the time delay, and $\dot{\phi}(f_0)$ is a first order of derivative of a measured phase response at a frequency $f_0$.

8. The method of claim 1, further comprising estimating the time delay according to approximately the following equation:

$$\hat{\tau}(f_0) = \frac{1}{f_0}\frac{f_1}{f_2 - f_1} - \frac{1}{360}\frac{1}{f_0}\phi(f_0) + \frac{0.5}{f_0} + \frac{1}{180}\frac{1}{f_0}\frac{1}{f_2 - f_1}\int_{f_1}^{f_2}\phi(f_{00})df_{00}$$

where $\hat{\tau}(f_0)$ is the time delay, $f_0$ is an operating frequency, $f_1$ is a first phase inflection frequency, $f_2$ is a second phase inflection frequency, and $\phi(f_0)$ is a measured phase response of the surface acoustic wave sensor, integral $\int_{f_1}^{f_2}\phi(f_{00})df_{00}$ is equal to

integral $\int_{f_1}^{f_2}\phi(f)df$, where $\phi(f)$ is a measured phase response at frequency $f$ and $f$ varies from $f_1$ to $f_2$.

9. The method of claim 1, further comprising estimating a propagation velocity of a surface acoustic wave through the surface acoustic wave sensor from an estimated time delay according to the following equation:

$\hat{v}(f)=\dfrac{L}{\hat{\tau}(f)}$, where $\hat{v}(f)$ is an estimated propagation velocity of the surface acoustic wave at frequency $f$, $\hat{\tau}(f)$ is the estimated time delay at the frequency $f$, and $L$ is a distance between centers of an input inter-digitized transducer (IDT) and an output IDT.

10. The method of claim 1, further comprising:

bringing a fluid into contact with a surface of the surface acoustic wave sensor; and

identifying a concentration of a material in the fluid as a function of an estimated propagation velocity, the estimated propagation velocity being estimated based on the estimated time delay.

11. The method of claim 1, wherein the surface acoustic wave sensor comprises a Love mode shear-horizontal surface acoustic wave sensor.

12. A computer-readable medium comprising instructions that when executed in a processor:

identify a segment of phase frequency response of a surface acoustic wave sensor; and

estimate a time delay associated with wave propagation through the surface acoustic wave sensor based on the identified frequency response.

13. The computer-readable medium of claim 12, further comprising instructions that when executed identify the segment of phase frequency response by determining

first and second phase inflection frequencies proximate to a running frequency associated with the surface acoustic wave sensor.

14. The computer-readable medium of claim 13, further comprising instructions that when executed determine phase inflection frequencies for a discrete phase frequency response by:

sampling a plurality of phase responses at frequencies proximate to the running frequency and initially estimating phase inflection frequencies as a function of the plurality of phase responses at frequencies proximate to the running frequency;

sampling a plurality of phase responses at frequencies proximate to the initially estimated phase inflection frequencies; and

more accurately estimating phase inflection frequencies as a function of the plurality of phase responses at frequencies proximate to the initially estimated phase inflection frequencies.

15. The computer-readable medium of claim 13, wherein the first and second phase inflection frequencies define edges of a monotonically changing subset of a graph of phase versus frequency of the surface acoustic wave sensor.

16. The computer-readable medium of claim 13, further comprising instructions that when executed estimate the time delay according to approximately the following equation:

$$\hat{\tau}(f_0) = \frac{f_1}{f_0}\frac{1}{f_2 - f_1} - \frac{1}{360}\frac{\phi(f_0)}{f_0} + \frac{0.5}{f_0}$$

where $\hat{\tau}(f_0)$ is the time delay at frequency $f_0$, $f_0$ is the running frequency, $f_1$ is the first phase inflection frequency, $f_2$ is the second phase inflection frequency, and $\phi(f_0)$ is a measured phase response of the surface acoustic wave sensor at the running frequency $f_0$.

17. The computer-readable medium of claim 12, further comprising instructions that when executed estimate the time delay according to approximately the following equation:

$$\hat{\tau}(f_0) = -\frac{1}{360}\frac{f_*}{f_0}\dot{\phi}(f_*) - \frac{1}{360}\frac{1}{f_0}\phi(f_0) + \frac{1}{360}\frac{1}{f_0}\phi(f_*)$$

where $\hat{\tau}(f_0)$ is the time delay, $f_0$ is a running frequency, $\phi(f_0)$ is a measured phase response of the surface acoustic wave sensor, $f_*$ is any frequency between a first phase inflection frequency and a second phase inflection frequency, $\phi(f_*)$ is a measured phase frequency response at the frequency $f_*$, and $\dot{\phi}(f_*)$ is a first order of derivative of the measured phase frequency response at the frequency $f_*$.

18. The computer-readable medium of claim 12, further comprising instructions that when executed estimate the time delay according to approximately the following equation:

$$\hat{\tau}(f_0) = -\frac{1}{360}\dot{\phi}(f_0)$$

where $\hat{\tau}(f_0)$ is the time delay, and $\dot{\phi}(f_0)$ is a first order of derivative of a measured phase response at a frequency $f_0$.

19. The computer-readable medium of claim 12, further comprising instructions that when executed estimate the time delay according to approximately the following equation:

$$\hat{\tau}(f_0) = \frac{1}{f_0}\frac{f_1}{f_2 - f_1} - \frac{1}{360}\frac{1}{f_0}\phi(f_0) + \frac{0.5}{f_0} + \frac{1}{180}\frac{1}{f_0}\frac{1}{f_2 - f_1}\int_{f_1}^{f_2}\phi(f_{00})df_{00}$$

where $\hat{\tau}(f_0)$ is the time delay, $f_0$ is an operating frequency, $f_1$ is a first phase inflection frequency, $f_2$ is a second phase inflection frequency, $\phi(f_0)$ is a measured phase response of the surface acoustic wave sensor, integral $\int_{f_1}^{f_2}\phi(f_{00})df_{00}$ is equal to integral $\int_{f_1}^{f_2}\phi(f)df$, where $\phi(f)$ is a measured phase response at a frequency $f$ and $f$ varies from $f_1$ to $f_2$.

20. The computer-readable medium of claim 12, further comprising instructions that when executed estimate a propagation velocity of the surface acoustic wave from the estimated time delay according to the following equation:

$\hat{v}(f)=\frac{L}{\hat{\tau}(f)}$, where $\hat{v}(f)$ is the estimated propagation velocity of the surface acoustic wave at frequency $f$, $\hat{\tau}(f)$ is the estimated time delay at frequency $f$, and $L$ is a distance between centers of an input inter-digitized transducer IDT and an output IDT.

21. The computer-readable medium of claim 12, further comprising instructions that when executed identify a concentration of a material in a fluid as a function of an estimated propagation velocity, the estimated propagation velocity being estimated based on the estimated time delay.

22. The computer-readable medium of claim 12, wherein the surface acoustic wave sensor comprises a Love mode shear-horizontal surface acoustic wave sensor.

23. A system comprising:

a surface acoustic wave sensor;

a sensor analyzer to receive output of the surface acoustic wave sensor; and

a processor to receive input from the sensor analyzer, identify a segment of phase frequency response of a surface acoustic wave sensor, estimate a time delay associated with wave propagation through the surface acoustic wave sensor based on the identified segment of phase frequency response.

24. The system of claim 23, wherein the processor identifies the segment of phase frequency response by determining first and second phase inflection frequencies proximate to a running frequency associated with the surface acoustic wave sensor.

25. The system of claim 24, wherein the processor determines the phase inflection frequencies by:

sampling a plurality of phase responses at frequencies proximate to the running frequency and initially estimating the phase inflection frequencies as a function of the plurality of phase responses at frequencies proximate to the running frequency;

sampling a plurality of phase responses at frequencies proximate to the initially estimated phase inflection frequencies; and

more accurately estimating the phase inflection frequencies as a function of the plurality of phase responses at frequencies proximate to the initially estimated phase inflection frequencies.

26. The system of claim 24, wherein the first and second phase inflection frequencies define edges of a monotonically changing subset of a graph of phase versus frequency of the surface acoustic wave sensor.

27. The system of claim 24, wherein the processor estimates the time delay according to approximately the following equation:

$$\hat{\tau}(f_0) = \frac{f_1}{f_0}\frac{1}{f_2 - f_1} - \frac{1}{360}\frac{\phi(f_0)}{f_0} + \frac{0.5}{f_0}$$

where $\hat{\tau}(f_0)$ is the time delay at frequency $f_0$, $f_0$ is the running frequency, $f_1$ is the first phase inflection frequency, $f_2$ is the second phase inflection frequency, and $\phi(f_0)$ is a measured phase response of the surface acoustic wave sensor at the running frequency $f_0$.

28. The system of claim 23, wherein the processor estimates the time delay according to approximately the following equation:

$$\hat{\tau}(f_0) = -\frac{1}{360}\frac{f_*}{f_0}\dot{\phi}(f_*) - \frac{1}{360}\frac{1}{f_0}\phi(f_0) + \frac{1}{360}\frac{1}{f_0}\phi(f_*)$$

where $\hat{\tau}(f_0)$ is the time delay, $f_0$ is a running frequency, $\phi(f_0)$ is a measured phase response of the surface acoustic wave sensor, $f_*$ is any frequency between a first phase inflection frequency and a second phase inflection frequency, $\phi(f_*)$ is a measured phase frequency response at the running frequency $f_*$, and $\dot{\phi}(f_*)$ is a first order of derivative of the measured phase frequency response at the running frequency $f_*$.

29. The system of claim 23, wherein the processor estimates the time delay according to approximately the following equation:

$$\hat{\tau}(f_0) = -\frac{1}{360}\dot{\phi}(f_0)$$

where $\hat{\tau}(f_0)$ is the time delay, and $\dot{\phi}(f_0)$ is a first order of derivative of a measured phase response at frequency $f_0$.

30. The system of claim 23, wherein the processor estimates the time delay according to approximately the following equation:

$$\hat{\tau}(f_0) = \frac{1}{f_0}\frac{f_1}{f_2 - f_1} - \frac{1}{360}\frac{1}{f_0}\phi(f_0) + \frac{0.5}{f_0} + \frac{1}{180}\frac{1}{f_0}\frac{1}{f_2 - f_1}\int_{f_1}^{f_2}\phi(f_{00})df_{00}$$

where $\hat{\tau}(f_0)$ is the time delay, $f_0$ is an operating frequency, $f_1$ is a first phase inflection frequency, $f_2$ is a second phase inflection frequency, and $\phi(f_0)$ is a measured phase response of the surface acoustic wave sensor, integral $\int_{f_1}^{f_2}\phi(f_{00})df_{00}$ is equal to integral $\int_{f_1}^{f_2}\phi(f)df$, where $\phi(f)$ is a measured phase response at frequency $f$, and $f$ varies from $f_1$ to $f_2$.

31. The system of claim 23, wherein the processor estimates a propagation velocity of the surface acoustic wave based on the estimated time delay according to the following equation:

$\hat{v}(f) = \frac{L}{\hat{\tau}(f)}$, where $\hat{v}(f)$ is an estimated propagation velocity of the surface acoustic wave at a frequency $f$, $\hat{\tau}(f)$ is the estimated time delay at the frequency $f$, and $L$ is a distance between centers of an input inter-digitized transducer IDT and an output IDT.

32. The system of claim 23, wherein the processor estimates a propagation velocity based on the estimated time delay.

33. The system of claim 32, wherein the processor identifies a concentration of a material in a fluid as a function of the estimated propagation velocity.

34. The system of claim 23, wherein the surface acoustic wave sensor comprises a Love mode shear-horizontal surface acoustic wave sensor.